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09/864,590	05/24/2001	Harry Stefan Barowski	DE900006US1	2120

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EXAMINER	
GERSTL, SHANE F	

ART UNIT	PAPER NUMBER
2183	5

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/864,590	BAROWSKI ET AL.	
	Examiner	Art Unit	
	Shane F Gerstl	2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 February 2003 and 30 August 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 May 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-10 have been examined.

Papers Received

2. Receipt is acknowledged of information disclosure statement and declaration and power of attorney papers submitted, where the papers have been placed of record in the file.

Priority

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 680. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Universal Load Address/Value Prediction Using Stride-Based Pattern History and Last-Value Prediction in a Two-Level Table Scheme.

6. The abstract of the disclosure is objected to because it is not completely clear what the characters in parentheses of lines 7, 15, and 16 in the body of the abstract are for. It appears that Applicant may be trying to refer to drawings in the disclosure for better description. Examiner points out that the abstract should be a concise technical statement of what is new in the art. This means that the abstract should stand alone in its ability to briefly state the new art being disclosed since referring to other parts of the disclosure prevents a concise statement. Correction is required. See MPEP § 608.01(b).

7. The disclosure is objected to because of the following informalities: the term "hybride" is used repeatedly throughout the specification when the correct spelling is "hybrid." There are also several grammatical errors throughout the specification. Some examples are in the first sentence of paragraph 28. First, the sentence should read "allows for prediction of last values" and not "allows to predict last values" in order to be grammatically correct. Also, the second part of this sentence is so unclear due to grammar mistakes that a solid suggestion cannot be given. These are just examples and similar such errors are repeated throughout the disclosure.

8. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Appropriate correction is required.

Claim Objections

9. Claims 1, 6, and 7 are objected to because of the following informalities: the claims use the term "hybride" when the correct speckling is "hybrid."

10. Claim 2 is objected to because of the following minor informalities: claim 2 states "a compare between the last result value from an earlier completed instance." This is improper grammar and should be "a compare between the last result value and an earlier completed instance" if the word compare is desired for use. This corrected phrase is the phrase the examiner is using to interpret the claim.

11. Claim 5 is objected to because of the following minor informalities: the word "signaling" is misspelled as "signalling."

12. Claim 10 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The only possible limitation of the claim is that the microprocessor's environment would be limited by placing it in a computer system. The claim would be further limiting if a microprocessor could exist outside of a computer system as well as within one. However, since a microprocessor device is a computer system, a microprocessor cannot exist outside of a computer system and therefore, it cannot be further limiting in this manner.

Claim Rejections - 35 USC § 112

13. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

14. Claims 2-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

15. Claim 2 recites the limitation "the last result value" in line 3 of the claim. There is insufficient antecedent basis for this limitation in the claim. There has been no prior definition of a result value and therefore the last result value is indefinite. The examiner is taking the claim to mean "a last result value," which allows for the introduction of a result value from a previous instruction.

16. Claim 3 recites the limitation "said first table" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

17. Claim 3 recites the limitation "the remaining counters" in line 4. There is insufficient antecedent basis for this limitation in the claim.

18. Claim 4 recites the limitation "the respective counter" in line 2. There is insufficient antecedent basis for this limitation in the claim.

19. Claim 4 recites the limitation "said counter" in line 3. There is insufficient antecedent basis for this limitation in the claim.

20. Claim 4 recites the limitation "the remaining counters" in line 4. There is insufficient antecedent basis for this limitation in the claim.

21. Claim 4 recites the limitation "the highest counter" in line 5. There is insufficient antecedent basis for this limitation in the claim.

22. Claim 5 recites the limitation "said threshold value" in line 3. There is insufficient antecedent basis for this limitation in the claim.

23. The excessive number of antecedent basis problems in the above claims 3-5 as well as the fact that each of these claims refers to a newly presented limitation of the claim directly preceding it has led the Examiner to believe that claim 3 was meant to be dependent on claim 2, claim 4 was meant to be dependent on claim 3, and claim 5 was meant to be dependent on claim 4. Therefore, the Examiner is examining the merits of this application based on the above suggested dependency chain of claims 3-5.

24. Claim 6 recites the limitation "a second plurality of stride fields" in lines 3-4. There is insufficient antecedent basis for this limitation in the claim. There has not been a first plurality of stride fields defined. A first plurality of entries in a table has been defined, but the stride fields are a part of the entries and not additional entries themselves. The Examiner is taking the claim to mean "a plurality of stride fields" as shown in the specification and figure 4.

25. Claim 6 recites the limitation "the same second plurality of counters" in line 5. There is insufficient antecedent basis for this limitation in the claim. It is completely unclear how "the same second plurality of counters" is stored when no counters have been introduced yet. The examiner believes the applicant means for a plurality of counters to be defined that are associated with the history pattern field based on the specification and figures. Therefore, the examiner is taking the claim to mean "a plurality of counters associated with the history pattern field."

26. Claim 6 recites the limitation "said second table" in line 8. There is insufficient antecedent basis for this limitation in the claim. A second table has not been defined, but, a pattern history table has been defined and therefore, based on this previously

defined term and the disclosure, the Examiner is taking the claim to mean, "said pattern history table."

27. The phrase of claim 6 that reads "...plurality of stride fields, a stride history pattern field, and a pattern history table..." is very unclear. The language seems to make the pattern history table be a part of the rest of the series given in the phrase. This would mean that each entry has a pattern history table, which is not what is disclosed in the detailed description or drawings. The examiner is taking the phrase to be "...plurality of stride fields and a stride history pattern field, and a pattern history table..." This allows for the entries of the first table to be composed of stride fields and a stride history pattern field where the prediction system includes a pattern history table and not the entries of the first table as is given in the detailed description and drawings.

Claim Rejections - 35 USC § 102

28. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

29. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Wang (Highly Accurate Data Value Prediction using Hybrid Predictors).

30. In regard to claim 1, Wang discloses a hybrid prediction method usable in parallel computing processors comprising using strides for a last-value-prediction, for a stride-based value prediction and for a history-pattern-based value prediction. Section 1 shows that value prediction is used for exploiting instruction-level parallel processing,

and thus the disclosure of Wang is usable in parallel computing processors. Figure 6 and section 5.2 shows a hybrid embodiment that uses last-value (the data values) prediction (as described in more detail as "last outcome" in section 2.2). This is further shown by looking at section 3.3, which shows that the two-level predictor uses past values and thus the hybrid predictor of 5.2, which uses the same base fields and structures, uses this prediction. Figure 6 and section 5.2 also show that stride prediction is also used in this hybrid. Finally the same section and figure clearly shows pattern based value prediction by virtue of the pattern history table and history pattern field.

Claim Rejections - 35 USC § 103

31. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

32. Claims 2-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang in view of Nakra (Global Context-Based Value Prediction).

33. In regard to claim 2,

a. Wang discloses the method according to claim 1, further comprising calculating a current stride from a compare between a last result value from an earlier completed instance of an instruction and the same instruction's current result, updating at least one counter of a plurality of saturating counters in a history tracking table according to the current value, and predicting a value

calculated from a compare of the last result value from an earlier completed instruction and the value stored in a value field containing a value beyond a hit threshold-value. Column one of page 285 shows that the stride is calculated by comparing (subtracting) the last result (D1) and an earlier completed instance (stored in value). The second column of page 285 and the top of page 286 show that the count in a pattern history (tracking) table has four counters that are updated according to the current value. It is also shown here that the counters saturate and are thus saturating counters. As shown above, the stride is calculated from a compare of an earlier instruction and the last result and figure 6 shows that a predicted data value is derived from the stride field holding this information. The top paragraph of column 2 of page 288 shows that a prediction is made when the value in an entry of the pattern history table is above a certain threshold.

b. Wang does not disclose that the history table is a stride history table, that the counter is updated according to the stride, and that the stride stored in a stride field is the value compared to the threshold. This stride functionality has been shown in Wang to be performed identically but with last value instead of stride prediction.

c. Nakra has taught in figure 6 the use of a plurality of stride fields (stride 1 and stride 2). The paragraph under figure 6 shows that the first stride is the difference between the last two values of an instruction and that the second

stride is updated when the first stride occurs twice in a row and thus there are two previous strides.

d. Nakra has taught in the last paragraph of the first page that stride prediction has been shown to improve prediction performance significantly over last value prediction. Last value prediction is the scheme used with the two-table method given by Wang in figure 6 as the data values store the last four result values. This performance improvement would have motivated one of ordinary skill in the art to modify the design given in section 5.2 of Wang to use a plurality of stride fields holding past strides for use in the two-level pattern prediction taught by Wang using strides. With these multiple strides incorporated into the design of section 5.2 of Wang, a history pattern field for these multiple strides and a pattern history table addressed by this history pattern field would be logical in order to take advantage of pattern-based prediction as shown to be an objective in the abstract of Wang. Then with these structures of Wang modified for use with strides, the stride history pattern would address the pattern history table and update the counters in it accordingly as disclosed by Wang. With stride data stored in the pattern history table, the threshold would then be compared with a stride field instead of a last value field.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Wang to incorporate multiple strides as taught by Nakra for the two-level history pattern prediction taught by Wang using strides so that significant performance improvements would have been realized.

34. In regard to claim 3, Wang in view of Nakra discloses the method according to claim 2, further comprising for an instruction not yet stored in said first table, initializing a counter reflecting its current result value with one saturation value, and the remaining counters with the respective opposite saturation value, and updating the counters corresponding to the occurrence of values calculated from the completion of later instances of the same instruction. The first paragraph of page 286 shows that the count is updated (at any time) by incrementing the correct outcome value by 3, which in a saturation counter and thus a saturation value. The remaining counters are shown to be decremented by 1. Since the value is decreasing it is moving in the opposite direction and since the value is in a saturating counter it is an opposite saturation value. Section 3.3 has shown that the counters are updated according to the occurrence of instances of the instructions, which are represented by each entry in the tables.

35. In regard to claim 4, Wang in view of Nakra discloses the method according to claim 3, further comprising incrementing the respective counter on occurrence of the same stride as selectable by said counter, and decrementing the remaining counters, and predicting a value calculated from the stride selectable by the highest counter if the highest counter has a value above a predetermined threshold value. As shown above, the counter corresponding to an occurrence of a stride is incremented and the counters are decremented. The last paragraph of page 285 shows that the highest (maximum) count is compared to a threshold and if above it, is used for the prediction.

36. In regard to claim 5, Wang in view of Nakra discloses the method according to claim 1, further comprising signaling that a value cannot be predicted when no counter

is above said threshold value. As shown in the above mentioned section, no prediction is made when the maximum count value is below the threshold value (and thus every counter is below the threshold).

37. In regard to claim 6,

a. Wang discloses a hybrid prediction system comprising circuits corresponding to a first table having a first plurality of entries (figure 6, value history table), each entry comprising a stride field (figure 6, stride) and a history pattern field (figure 6, value history pattern), and a pattern history table (figure 6) storing a plurality of counters associated with the history pattern field and being arranged to be addressable by a two-table look-up mechanism using a history pattern for selecting an entry in said pattern history table, and the counters being arranged for being updated according to the occurrences of patterns. The pattern history table for the embodiment of figure 6 and section 5.2 are discussed in greater detail in section 3.3. The second column of page 285 and the top of page 286 show that the pattern history table stores four counters that give a history of the patterns given in the history pattern field. Then, this section and figures 4 and 6 show that the pattern history table is addressable by the history pattern field of the value history table, which selects an entry of the pattern history table. This section also shows that these counters are updated according to occurrences of patterns.

b. Wang does not disclose that there are a plurality of stride fields, that the history pattern field is a stride history pattern field (it is a value history pattern

field), that the counters are associated with stride fields (they are associated with data value fields), and that the pattern history table is addressable with the stride history pattern (it is addressable with a value history pattern) and updates according to stride patterns (this updating is done with value patterns).

c. Nakra has taught in figure 6 the use of a plurality of stride fields (stride 1 and stride 2). The paragraph under figure 6 shows that the first stride is the difference between the last two values of an instruction and that the second stride is updated when the first stride occurs twice in a row and thus there are two previous strides.

d. Nakra has taught in the last paragraph of the first page that stride prediction has been shown to improve prediction performance significantly over last value prediction. Last value prediction is the scheme used with the two-table method given by Wang in figure 6 as the data values store the last four result values. This performance improvement would have motivated one of ordinary skill in the art to modify the design given in section 5.2 of Wang to use a plurality of stride fields holding past strides for use in the two-level pattern prediction taught by Wang using strides. With these multiple strides are incorporated into the design of section 5.2 of Wang, a history pattern field for these multiple strides and a pattern history table addressed by this history pattern field would be logical in order to take advantage of pattern-based prediction as shown to be an objective in the abstract. Then with these structures of Wang modified for use

with strides, the stride history pattern would address the pattern history table and update it accordingly as disclosed by Wang.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Wang to incorporate multiple strides as taught by Nakra for the two-level history pattern prediction taught by Wang using strides so that significant performance improvements would have been realized.

38. In regard to claim 7, Wang in view of Nakra discloses the hybrid prediction system according to claim 6 in which the number of stride fields is greater than 3 and less than 7. Wang has shown in figure 6 that the number of fields (data values) that are used to populate the history pattern (as discussed above) is 4. As shown above, these fields have been shown to be stride fields with the obvious modification.

39. In regard to claim 8, Wang in view of Nakra discloses a sub-unit for use in microprocessor devices having at least one prediction system according to claim 7. Section 1 shows that value prediction is used for exploiting instruction-level parallel processing and thus the system of figure 6 is a sub-unit for use in a processor or microprocessor.

40. In regard to claim 9, Wang in view of Nakra discloses a microprocessor device having at least one sub-unit according to claim 8. As shown above, the sub-unit is for use in a microprocessor and so it is in the processor.

41. In regard to claim 10, Wang in view of Nakra discloses a computer system having a microprocessor device according to claim 9. Since the microprocessor is a computer system, this claim is also met with the above argument.

Conclusion

42. The following is text cited from 37 CFR 1.111(c): In amending in reply to a rejection of claims in an application or patent under reexamination, the applicant or patent owner must clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. The applicant or patent owner must also show how the amendments avoid such references or objections.

43. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references have been cited to further show the art with respect to stride and hybrid prediction in general.

US Pat No 5,919,256 to Widigen shows an operand cache that acts as a table of stored values used for speculative execution based on previous instances of the instructions.

US Pat No 6,516,409 to Sato discloses a data value prediction scheme using previous values and strides.

"Path-Based Next Trace Prediction" to Jacobson teaches hybrid value predicting based on a two-level correlating table approach.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shane F Gerstl whose telephone number is (703)305-7305. The examiner can normally be reached on M-F 6:45-4:15 (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (703)305-9712. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shane F Gerstl
Examiner
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April 2, 2004

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